

CLAIMS

We claim:

1. A high modulus turbine blade comprising:
 - a base portion and a tip portion;
 - a primary direction that extends from said base portion to said tip portion; and
 - said turbine blade being formed of a base metal that has a crystallographic orientation, said crystallographic orientation having a high modulus direction, wherein said high modulus direction is aligned with said primary direction.
2. The turbine blade as recited in claim 1, wherein said high modulus direction is aligned to within a cone of about ten degrees of said primary direction.
3. The turbine blade as recited in claim 1, wherein said base metal is a Fe based alloy.
4. The turbine blade as recited in claim 1, wherein said base metal is a Ni based alloy.
5. The turbine blade as recited in claim 4, wherein said Ni based alloy is a superalloy composition comprising 1-16% Cr, 0-3% Mo, 3-13% W, 0-8% Re, 0-14% Ta, 3-7% Al, 0-20% Co, 0-0.1% C, 0-0.02% B, 0-0.1% Zr, 0-2% Hf, 0-2% Nb, 0-1% V, 0-2% Ti, 0-10% (Ru+Rh+Pd+Os+Ir+Pt), 0-0.25% Y, and the balance Ni.

6. The turbine blade as recited in claim 1, wherein said base metal is a Co based alloy.
7. The turbine blade as recited in claim 1, wherein said base metal is a Mo based alloy.
8. The turbine blade as recited in claim 1, wherein said base metal is a Nb based alloy.
9. The turbine blade as recited in claim 1, wherein said base metal is an Al based alloy.
10. The turbine blade as recited in claim 1, wherein said base metal is a Ti based alloy.
11. The turbine blade as recited in claim 1, wherein said turbine blade has been heat treated to recrystallize the base metal with said high modulus direction aligned with said primary direction.

12. An aircraft engine comprising:
 - a fan;
 - a compressor in at least partial fluid communication with said fan;
 - a combustor in fluid communication with said compressor portion; and
 - a turbine in fluid communication with said combustor, said turbine comprising a rotor having at least one high modulus turbine blade that has a primary direction that extends from a base portion to a tip portion of said high modulus turbine blade, said high modulus turbine blade being formed of a base metal that has a crystallographic orientation, and said crystallographic orientation having a high modulus direction, wherein said high modulus direction is aligned with said primary direction.
13. The aircraft engine as recited in claim 12, wherein said high modulus direction is aligned within about ten degrees of said primary direction.
14. The aircraft engine as recited in claim 12, wherein said base metal is a Fe based alloy.
15. The aircraft engine as recited in claim 12, wherein said base metal is a Ni based alloy.

16. The turbine blade as recited in claim 15, wherein said Ni based alloy is a superalloy composition comprising 1-16% Cr, 0-3% Mo, 3-13% W, 0-8% Re, 0-14% Ta, 3-7% Al, 0-20% Co, 0-0.1% C, 0-0.02% B, 0-0.1% Zr, 0-2% Hf, 0-2% Nb, 0-1% V, 0-2% Ti, 0-10% (Ru+Rh+Pd+Os+Ir+Pt), 0-0.25% Y, and the balance Ni.

17. The aircraft engine as recited in claim 12, wherein said base metal is a Co based alloy.

18. The aircraft engine as recited in claim 12, wherein said base metal is a Mo based alloy.

19. The aircraft engine as recited in claim 12, wherein said base metal is a Nb based alloy.

20. The aircraft engine as recited in claim 12, wherein said base metal is an Al based alloy.

21. The aircraft engine as recited in claim 12, wherein said base metal is a Ti based alloy.

22. The turbine blade as recited in claim 12, wherein said turbine blade has been heat treated to recrystallize the base metal with said high modulus direction aligned with said primary direction.

23. A method of tuning the natural vibration frequency of a turbine blade comprising the step of:

increasing the elastic modulus in the primary direction of the turbine blade, wherein the primary direction is a direction that extends from a base portion to a tip portion of the turbine blade.

24. The method as recited in claim 23, further including the step of aligning a high modulus direction of a base metal within a cone of about ten degrees of the primary direction of the turbine blade.

25. The method as recited in claim 23, wherein the base metal is selected from the group comprising Fe, Ti, Co, Ni, Mo, Nb, and Al based alloys.